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COURSES IN OPTICS AND OPTOMETRY

ANNOUNCEMENT 1917-1918

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1. Annual Reports of the President and Treasurer to the Trustees.

2. The Catalogue of the University, price 25 cents, and the Announcements of the several Colleges and Schools, and of certain Divisions, issued in the Spring, and relating to the work of the next year. These are made as accurate as possible, but the right is reserved to make changes in detail as circumstances require. The current number of any of these Announcements will be sent without charge upon application to the Secretary of the University.

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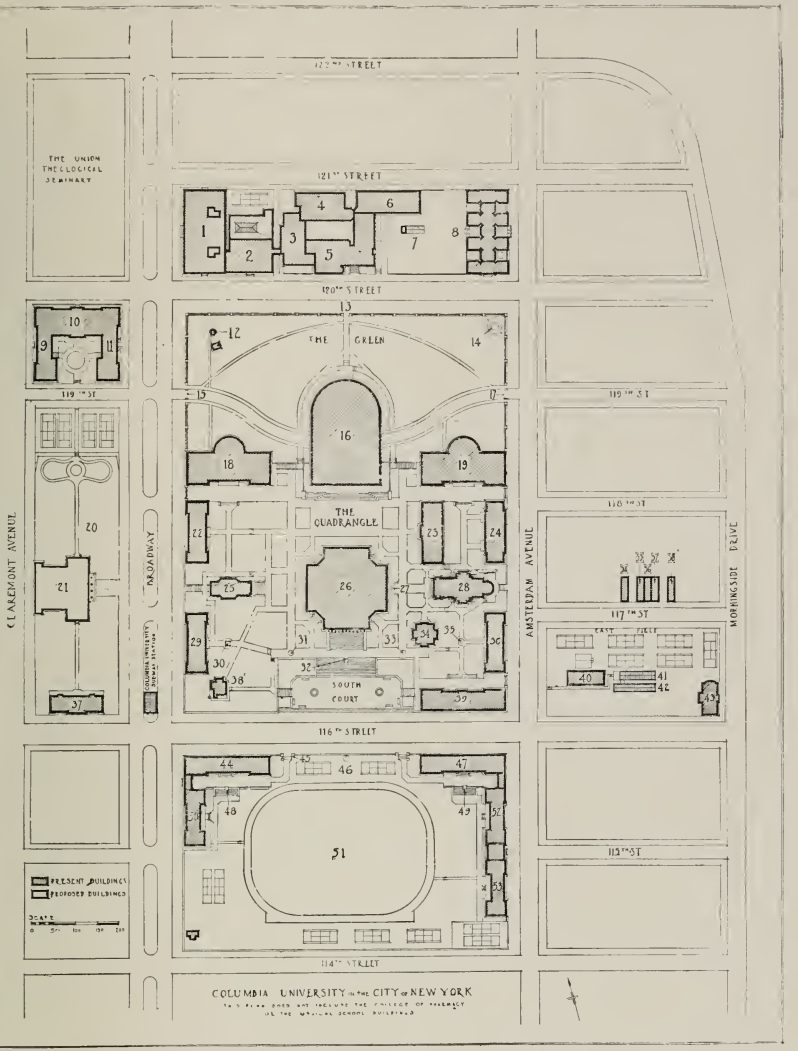

Teachers College
1. Horace Mann School
2. Thompson Memorial Bldg.
3. Milbank Memorial Chapel
4. Macy
5. Main Building
6. Household Arts
7. Peabody Greenhouse
8. Whittier

Barnard College
9. Fiske
10. Milbank
11. Brinckerhoff
20. Milbank Quadrangle
21. Students' Building
37. Brooks Hall

Columbia University
12. Wilde Observatory
13. Class of 1882 Gates
14. Statue of the great God Pan
15. Mapes Gates
16. University
17. Class of 1888 Gate
18. Havemeyer
19. Schermerhorn
22. Engineering
23. Avery
24. Fayerweather
25. Earl
26. Library
27. Class of 1886 Exedra
28. St. Paul's Chapel
29. Mines
30. Meunier's Hammerman, 1889 Mines Class Gift
31. Lafayette Post Flag Staff
32. Statue of Alma Mater
33. Class of 1881 Flag Staff
34. East
35. Class of 1887 Well Head
36. Philosophy
38. Faculty Club
39. Kent
40. Crocker Research
41. Botany Greenhouse
42. Agriculture Greenhouse
43. President's House
44. Journalism
45. Classes of 1884 and 1899 Tablet
46. Class of 1885 Sun Dial
47. Hamilton
48. Jefferson Statue
49. Hamilton Statue
50. Furnald
51. South Field
52. Hartley
53. Livingston
54. Deutsches Haus
55. Dean Keppel
56. Chaplain Knox
57. Maison Francaise
58. Carnegie Endowment

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Anatomy, Physiology and Practical Optics

INTRODUCTORY AND HISTORICAL

The oldest applications of optics were undoubtedly for the purpose of aiding vision. Apparently, convex spectacles were invented towards the end of the thirteenth century, perhaps by Roger Bacon in England or by some of his contemporaries in Italy. Concave glasses were introduced soon afterwards. Not until the latter part of the eighteenth century was there any noteworthy progress in the art of making spectacles. Benjamin Franklin was the first to use bifocal glasses. Periscopic lenses were recommended by W. H. Wollaston. Astigmatism in the human eye was discovered by Thomas Young in 1801; and Sir George Airy, about 1827, corrected this error in his own eye by means of a cylindrical lens. Probably no scientific labors have ever been attended with greater blessings to mankind than the brilliant work in ophthalmology of Donders in Holland and of von Helmholtz in Germany.

Recent years have likewise witnessed extraordinary progress both in ophthalmology and in applied optics, and it would be difficult to overestimate the importance of the applications in this domain of science of the remarkable theories of Allvar Gullstrand, who was awarded the Nobel Prize in Medicine in 1911, and upon whom the mantle of von Helmholtz seems to have fallen. Every field of optics has felt already the influence of this new leader, and the present is a period of great activity and promise in every direction in optics.

Few persons are perhaps aware of the rapid rate at which spectacle-optics in particular is developing into a severe scientific pursuit. It would be a very superficial view to suppose that modern improvements in the manufacture of spectacles consisted chiefly in the introduction of lighter frames and of new processes of fusing bifocal lenses or of grinding toric surfaces; although these and other mechanical refinements are by no means insignificant achievements. Under the influence of the new teaching, the theories of vision have been revised and new points of view have led to the calculation and design of wonderfully improved types and combinations of spectacle-lenses, which are only just now finding their way to England and America. Great strides have been made in these countries in the training of technical opticians and optometrists to deal with the complex and often very intractable problems of astigmatism, of both eyes and lenses, and with the investigation of the various anomalies and defects of vision that require to be corrected.

In England a significant effect of the increased interest in these subjects is to be seen in the recent establishment of an institute of optical engineering in London, where a student will be able to pursue extensive studies in optics, both theoretical and applied; including courses not only in such subjects as physiological optics and the making, testing and fitting of spectacle-lenses, but especially in the principles, design and construction of optical instruments (telescopes, microscopes, photographic apparatus, spectroscopes, projection lanterns, sur-

veying and measuring instruments, range-finders, etc.), and where optical researches will be encouraged and systematic investigations of the methods of manufacture of optical glass (which now has to be imported from the continent) can be prosecuted. Probably the time is not far distant when the demand for such an institution in this country will have to be met.

OPTOMETRY

The practice of optometry, which is defined as "the employment of any means, other than the use of drugs, for the measurement of the powers of vision and the adaptation of lenses for the aid thereof," has been regulated by law in thirty-eight states, as follows: Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Rhode Island, South Dakota, Tennessee, Utah, Vermont, Virginia, Washington, West Virginia and Wisconsin; and legislation is pending in other states.

While the requirements for license to practice optometry vary from state to state, it may be noted here that in order to be qualified to take the optometry examinations of the New York State Board, the applicant must be at least twenty-one years of age, and, in addition to having had a preliminary training of at least two years in an accredited high school, must give evidence of having studied optometry for several years, preferably by presenting a certificate of graduation from a registered school of optometry. These requirements may be revised before June 1918; and in particular the high school training requirement may be increased from two years to four years. The examinations of the New York State Board are held in the winter, summer and autumn of each year.

Under the stimulus of such legislation, the new profession of optometry is rapidly developing in importance. Improved instruments for retinoscopy and keratometry are already in evidence, and the young opticians, very keen to be in the forefront, are attracted to this calling not only because it holds out prospects of gaining a good livelihood, but especially also because it has rich possibilities of fame and advancement for those who pursue it with ability and enthusiasm.

A student in college who looks forward to a profession based on scientific training will find it well worth while to investigate the opportunity for usefulness and success which is afforded in this field. Optometry opens also to women an entire new territory which seems to hold out special inducements to them.

In 1910, upon the special solicitation of the Department of Education of the State of New York, and in compliance with the law of the state (Public Health Law, Chapter 45 of the consolidated laws, effective Feb. 17, 1909), courses in practical optics for optometrists were offered for the first time in Columbia University under the supervision of the Administrative Board of Extension Teaching in connection with the Department of Physics. These courses, arranged at present in a curriculum of two years, include such subjects as mathematics, physics, theoretical optics, general anatomy and physiology, theoretical optom-

etry, practical optometry, physiological optics and pathological conditions of the eye; and are intended to provide special training in optics for those who are or expect to be optometrists. The proper treatment of refraction-errors of the eye requires to-day on the part of the practitioner a knowledge of geometrical and physiological optics which cannot be obtained in the courses offered in the colleges or medical schools of the country. While, therefore, it is true that the courses in practical optics as outlined in the following pages have been planned especially with a view to the needs of the professional optometrist, they include just that training in visual optics that is desirable for medical students who are preparing to be oculists.

ADMISSION

State Requirement

The classes in optics and optometry given by Columbia University comprise a professional course approved by the Regents of the State of New York, and candidates cannot be admitted to this course until they file with the University a qualifying certificate issued by the Regents, showing that they have had the necessary preliminary training. Candidates for admission are, therefore, urged to correspond with the State Department of Education, Albany, New York, in regard to this qualifying certificate. They should have this certificate in their possession when they present themselves for registration in the autumn. In addition to presenting the qualifying certificate, students must satisfy also the University regulations as outlined below.

University Requirements for Admission

The requirement for admission to the courses in Optics and Optometry is on the basis of entrance examinations and in number of units is the same as for admission to Columbia College. This requirement is proficiency—as tested by examination in connection with the school record of the candidate—in fifteen units of secondary school studies as specified below. Students who can present only 14 units will be admitted on condition, provided that the deficiency be removed during the first year. A unit implies the study of a subject for a time equivalent to five hours for one year.

Total requirement ..... 15 units

Candidates must offer:

English	1. Grammar and Composition	1½ units
	2. Literature	1½ units
Mathematics	*a*, i Algebra to Quadratics	1 unit
	a, ii Quadratics and beyond	1 unit
	c Plane Geometry	1 unit

Elective subjects, chosen in any manner from the three groups below .... 9 units

In making this choice it is desirable that the nine units of elective subjects be chosen as nearly as possible according to the following scheme:

Five units from Group I, including Elementary German (or French), Elementary History and Drawing; two units from Group II, namely, one unit in

Advanced Mathematics (Trigonometry), and one unit in a modern language (Intermediate German or French); and two units from Group III, including Shopwork (Manual Training) and one science, preferably Chemistry.

Group I

Elementary French ..... 2 units
Elementary German ..... 2 units
Italian ..... 1 unit
Spanish ..... 2 units
Elementary History ..... 2 units
Drawing ..... 1 unit

Group II

Intermediate French ..... 1 unit
Intermediate German ..... 1 unit
Advanced English ..... 1 unit
Advanced History ..... 1 unit
Advanced Mathematics ..... ½, 1, or 1½ units
(Solid Geometry, College Algebra, or Trigonometry)
Elementary Latin ..... 2, 3, or 4 units
Elementary Greek ..... 2 3, or 4 units

Group III

Botany ..... 1 unit
Chemistry ..... 1 unit
Physics ..... 1 unit
Physiography ..... 1 unit
Zoölogy ..... 1 unit
Shopwork (Manual Training) ..... 1 unit

Students intending to take the courses in Optics and Optometry should apply to the Secretary of the University for the current *Announcement of Entrance Examinations and Undergraduate Admission.* In this circular will be found described in detail the requirements in each subject designated above and printed syllabi of the work to be covered.

ENTRANCE EXAMINATIONS AND SCHOOL RECORDS

The examination requirements for admission may be satisfied by any one of the three following means, or by any approved combination thereof; the examination grades are interpreted in the light of the record which the student has made in school. The record for each subject must be filed with the Committee on Admissions.

1. By the examination of the College Entrance Examination Board, held in June at Columbia University, and at about one hundred and fifty other educational centers in the United States and Europe.

2. By the examinations conducted at Columbia University by the Committee on Admissions. These examinations are held in September and January of each year.

3. By the examinations of the New York State Examination Board, in so far as their subject matter specifically corresponds to the stated requirements for entrance to the courses in Optics and Optometry in Columbia University. These examinations are held in January and June at more than six hundred high schools and other institutions in the state, but are ordinarily open only to students in those schools.

Students are urged to undertake their entrance examinations as early in their high school work as possible. It is a good plan to take the first examination in January of the last year in the high school and the second examination in June, and if there yet remain subjects not passed, a third examination in September of the year in which the candidate intends to enter the course. Students who enter through credentials obtained from the Regents of the State of New York will naturally take their examinations at various times throughout their high school course.

COLLEGE STUDENTS

College graduates and college students who have been at least one year in an approved college and are in good standing will be admitted to the courses in Optics and Optometry without entrance examinations.

Credits for subjects taught in the optometry curriculum cannot usually be given for work done elsewhere; but in some cases, for example, where the applicant has had extensive practical experience along certain lines, credit may be given after satisfactory test by examination.

PREPARATORY COURSES IN EXTENSION TEACHING

For the benefit of students who desire to take the optometry courses but who, notwithstanding the fact that they have graduated from a high school, are unable to present the full quota of fifteen units required for entrance, attention is directed to the *Announcement of Extension Teaching*, which may be obtained by applying to the Secretary of the University. Herein are listed a large number of special courses given in the afternoon and evening, including such subjects as English, History, Mathematics (Algebra, Plane and Solid Geometry and Plane Trigonometry), French, German, Latin, Chemistry, Physics and Drawing; each of which will be accepted as equivalent to one or more units for entrance. Advice will be given to any one who desires to pursue this plan of obtaining such additional credit as is needed to meet the requirements for entrance to the courses in Optics and Optometry.

REGISTRATION

The courses begin in September with the opening of the college year, and new students must enter at that time. Students are required to register at the office of the Registrar in Room 315 University Hall. A student in Optics and Optometry must register for the Winter Session, and must renew his registration in person at the beginning of the Spring Session. Students will be allowed to attend one lecture before registration and payment of fees. Registration for the Winter Session begins September 19; for the Spring Session, February 4.

The Registrar's office is open regularly from 9 a.m. to 5 p.m., except on Saturdays, when the office closes at noon.

FEES

Students must pay all fees at the office of the Bursar in University Hall. This office is open daily from 9:30 a.m. to 3:30 p.m.; Saturday morning from 9 to 12.

Fees must be paid before entering upon the course.

After the second Saturday following the opening of either Session, no reduction or return of fees will be made to persons who discontinue any course or courses for which they have registered. Exception to this rule may be made in the case of those who, because of serious personal illness certified to by the University Medical Officer, are obliged to withdraw entirely from all of their courses. In considering such applications the student will be regarded as having withdrawn upon the date on which the Registrar receives from him notice of his withdrawal, and any refund will be reckoned from that date.

Every student must pay a University fee of $5 for every year or any part thereof.

Tuition fees, at the rate of $6 per point, for the complete schedule of courses:

First Year	$186
Second Year	180

UNIVERSITY PRIVILEGES

All students have free access to the library and may draw books for home use.

The University Medical Officer, Dr. W. H. McCastline, holds office hours daily in Earl Hall for consultation with students. Dr. McCastline has direct supervision of all matters affecting the health of the student body.

Men have the privilege of residence in the University dormitories; women may reside in Whittier Hall. Dining-rooms for men and women are located in University Hall. There are also many good boarding houses and apartments near the University. A card catalogue of selected and registered apartments and rooms is kept in Earl Hall for the convenience of students.

The privileges of the University Gymnasium are open to men.

Attention is directed to the courses in physical education, which are strongly recommended for students of optometry.

ATTENDANCE, EXAMINATIONS AND REPORTS

Examinations are regularly held at the close of each Session. A report is sent to the Director by the various instructors in the middle of each Session, approximately on November 15 and March 25. A student whose work in any of his courses is unsatisfactory may be dropped by the Administrative Board at any time.

GRADES

A student's performance in his classes is reported by the following grades, the passing marks *A*, *B* and *C*, signifying "excellent," "good," "fair," respectively;

the mark *D* meaning deficiency removable by re-examination, and the mark *F* meaning a complete failure which can be removed only by repeating the course.

Deficiency Examinations for the benefit of students receiving the grade *D* in one or more subjects will be held within the two weeks immediately preceding the opening of the University in the autumn. Applications for such examinations must be filed with the Registrar on or before Monday, September 10, 1917. The fee is five dollars for special examination in each subject, with five dollars additional for applications received after the specified date which must be paid when the application is made. In the exceptional case of a student intending to take the autumn examinations of the New York State Board, deficiency examinations may by special arrangements be given during the Summer Session.

ABSENCES

It is a student's duty to attend punctually every class or laboratory exercise in each course.

A student may, however, be absent without penalty (other than the inevitable handicap in his work) in a Session as follows: from a course meeting once weekly, twice; from a course meeting twice weekly, three times; from a course meeting three times weekly, four times; from a course meeting four times weekly, five times; and from a course meeting five times weekly, six times.

In case this limit is exceeded, a student receiving a grade of *C* or higher may submit a statement showing the cause of each absence. If, in the judgment of the Administrative Board, these causes were imperative, full or partial credit for the course may be assigned by the Director upon the recommendation of the Administrative Board, in accordance with the extent and reason of the student's absences and the standing attained in the course.

Tardiness counts as half an absence.

CERTIFICATE

The University does not offer a degree or diploma in these courses, but, on the successful completion of the program of studies a certificate of graduation in optometry will be given.

LABORATORIES AND CLINICAL ADVANTAGES

Experimental work in physics and in theoretical optics is conducted in the regular college laboratory of the Department of Physics. The optometry laboratories, situated on the top floor of Fayerweather Hall, which is the University building devoted to Physics, are supplied with the best modern optometrical instruments, and with all the mechanical appliances for making ophthalmic lenses and for assembling and adjusting frames and mountings.

Loans of valuable apparatus and machinery have been made by various organizations interested in the training of optometrists, notably by the New York State Optical Society. Recently the equipment has been greatly increased by generous gifts made by the American Optical Company, of Southbridge, Mass., and the Standard Optical Company, of Geneva, N. Y.; which include the latest

types of machines for grinding, surfacing, edging, drilling, cutting, etc.; so that the facilities for work in mechanical optics are unsurpassed.

A very important and significant announcement is the assurance of the active sympathy and coöperation of the Bausch & Lomb Optical Co., of Rochester, N. Y., whereby the Department of Physics in Columbia University will be put in direct touch with the result of the work in optics which is being carried on by the scientific and technical staffs of the Bausch & Lomb Optical Co. Moreover, for instruction in the courses in optics, this company has generously offered to supply any of the instruments and apparatus which they make, and especially the modern ophthalmological instruments which they have recently developed.

Clinical instruction is given under the direct supervision and guidance of men of wide practical experience distinguished in their profession. The students make examinations themselves and acquire skill in this work; while the teacher points out the peculiarities of each case and the proper mode of treating it.

As a further assistance to students in gaining proficiency in actual optometrical practice, a dark room has been equipped with every necessary appliance for the examination of eyes. This room is in charge of an instructor.

In the Spring Session, beginning early in February and continuing until the end of May, an Optometric Clinic, which is free to the public, is conducted in Fayerweather Hall, Rooms 609 and 607, every Saturday afternoon, from 4 to 6 o'clock. The students of the graduating class act as assistants to the instructors in charge of this clinic. A preliminary examination of each patient is made by one of the students in attendance, which is then checked and criticized by the clinical staff.

In the present year, each member of the graduating class, beginning February, 1917, is having the opportunity of spending an entire week in the office of Mr. Charles F. Prentice, of New York, and of observing his methods and procedure in his daily practice. An extra fee of $6 is charged for this course; and while at present it is not obligatory and therefore not included in the regular program of studies, it is expected that every student will avail himself of this unusual privilege.

SCHOLARSHIPS

The American Optical Company, with the laudable aim of encouraging deserving young men and women who are ambitious to obtain a higher training in applied optics, has founded two scholarships in the courses in optics and optometry to be awarded regularly each year. These scholarships have an annual value ranging from $180 to $186 to cover the tuition charges. Applicants should write to the American Optical Company, Southbridge, Mass. The holders, who must, of course, comply with the requirements for entrance, will be subject to all the rules and regulations of the University.

PROGRAM OF STUDIES

FIRST YEAR

Winter Session

Optometry A1—Algebra, geometry and trigonometry. Professor SOUTHALL

9–10 a.m., Monday, Wednesday, Friday, and 10–11 a.m., Tuesday and Thursday. Fee $24

This is a general course in such branches of mathematics, especially algebra, geometry and trigonometry, as bear more directly on the fundamental problems of geometrical optics. The elements of projective geometry will be included.

Physics A1—General elementary physics. Professor DAVIS and Mr. FARWELL

11 a.m.–12 m., Tuesday, Thursday and Saturday, with additional two hours of laboratory work one afternoon each week. Fee $24

Physics eA1—An alternative evening course (which is the only course open to women). Mr. BROWN, Mr. FARWELL and Mr. ULREY

7:30–9 p.m., Monday and Thursday, Room 304 Fayerweather; with additional two hours of laboratory work in the evening. Fee $24

The courses in elementary physics are intended to give to students an acquaintance with the general results, the spirit and the methods of the science. The place of optics in the field of science as a whole is thus made clear, as is the relation of the fundamental principles of light to those of other branches of physics. The laboratory work is intended to develop not only further familiarity with the general principles, but systematic observation of facts and clear presentation of results as well; to teach the accurate measurement of physical quantities and a correct idea of the trustworthiness of a measurement.

Text-book: Kimball's *College Physics*, Henry Holt and Co., 1912.

Note.—Men who offer physics for entrance are advised to take the intermediate course, Physics B, in place of the more elementary course, Physics A, although the latter includes all the physics that is required for the optometry certificate. In case a student who is thus qualified elects to take the higher course, it will be only under very exceptional circumstances that he will be permitted afterwards to drop it and substitute Physics A in its place.

Optometry 1—Theoretical optics. Professor SOUTHALL

10–11 a.m., Monday, Wednesday and Friday. Fee $18

After a general outline of the subject of geometrical optics, special attention is given during the Winter Session to reflection by plane and curved mirrors and refraction at plane surfaces. In the Spring Session the subject of refraction is treated with reference to prisms and simple curved surfaces and to the discussion of simple lenses. Throughout the course, emphasis is laid upon the fundamental principles involved, and the applications of these principles are illustrated by the solution of many numerical problems.

Optometry 3—General anatomy with special reference to the anatomy and physiology of the eye. Professor WOLL

5–6 p.m., Wednesday; 4–6 p.m., Friday. Fee $18

This course aims, by the aid of demonstration, laboratory work and text-books, to convey a knowledge of the structure of the eye, of the refraction of light in the media of the eye, and of the action of the retina and of the ocular muscles.

Text-books: Huxley and Lee's *Elementary Physiology;* Woll's *Technique of Eye Dissections.*

Spring Session

Physics A2—General elementary physics. Professor DAVIS and Mr. FARWELL

11 a.m.–12 m., Tuesday, Thursday and Saturday, with additional two hours of laboratory work one afternoon each week. Fee $24

This is a continuation of Physics A1.

Physics eA2—An alternative evening course (which is the only course open to women). Mr. BROWN, Mr. FARWELL and Mr. ULREY

7:30–9 p.m., Monday and Thursday, with additional two hours of laboratory work in the evening. Fee $24

This is a continuation of Physics eA1.

Optometry 2—Theoretical optics. Professor SOUTHALL

10–11 a.m., Monday, Wednesday and Friday, together with two hours of laboratory work each week, Friday afternoon or Saturday morning. Fee $24

This is a continuation of Optometry 1 as outlined above. The laboratory work includes simple experiments on reflection and refraction, determination of index of refraction by simple apparatus, and an introduction to the use of the optical bench for the measurements of the focal lengths of spherical mirrors and lenses.

Optometry 4—General anatomy with special reference to the anatomy and physiology of the eye. Professor WOLL

5–6 p.m., Wednesday and 4–6 p.m., Friday. Fee $18

This is a continuation of Optometry 3.

Optometry 6—Practical optics. Professor WOLL and Mr. ROBERTS

7–10 p.m., Tuesday. Fee $18

In this course the fundamental principles governing practical optics will be taught. Lectures on the history and manufacture of glass and lenses, and on the composition of various kinds of glasses will be given. Laboratory equipment and methods will be specially considered. There will be required work in the use of abrasives, simple surface and edge grinding, lens centering, neutralizing, transposition and pattern making.

Optometry 8—Theoretical optometry. Professor WOLL

8–9:30 a.m., Tuesday, and 9–10:30 a.m , Saturday. Fee $18

This course will begin with a brief review of the history, growth, and evolution of optometry, followed by discussions of the various principles, methods, and instruments used to detect and measure errors of ocular refraction. Instructions will be given in the elementary use of such devices as test-lenses, test types, skiascope, ophthalmoscope, ophthalmometer, etc. The relative values of the various instruments in use for finding ocular errors of refraction will be considered and discussed.

The further aim of the course is to equip the student with a working knowledge sufficient to correct the simpler defects of the eye, and to give a good general and practical understanding of the elements of practical optometry.

Text-books: Burnett, *Principles of Refraction in the Human Eye;* Cross, *Dynamic Skiametry;* Prentice, *Ophthalmic Lenses;* Souter, *The Refractive and Motor Mechanism of the Eye.*

SECOND YEAR

Winter Session

Optometry 9—Theoretical optics. Professor SOUTHALL

11 a.m.–12 m., Monday, Wednesday and Friday, together with two hours of laboratory work each week, Friday afternoon or Saturday morning. Fee $24

In this course the work of the first year in Optometry 1 and 2 is continued. The Winter Session is occupied with a discussion of thick lenses and combinations of thin lenses. The elements of the


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Gauss theory are also treated. As far as possible each topic is illustrated by a number of problems and original exercises. The work on combinations of lenses is continued in the Spring Session and an introduction is given to the calculations for the corrections for spherical and chromatic aberrations. Some attention is also paid to certain important topics in physical optics, such as interference, diffraction and polarized light. The Winter Session's work is accompanied by two hours of laboratory work per week, including experiments with combinations of lenses, photometry, the use of the spectrometer, etc.

Prerequisites: Optometry 1 and 2.

Optometry 11—Physiological optics. Professor SOUTHALL

2–3 p.m., Monday and Thursday, and 11 a.m.–12 m., Tuesday. Fee $18

The lectures cover the theories of accommodation and color vision, as well as monocular and binocular vision, convergence, strabismus, astigmatism, entoptic phenomena and related subjects.

Text: Tscherning, *Physiological Optics.*

Prerequisites: Optometry 1, 2, 3 and 4.

Optometry 13—Practical optics. Professor WOLL and Mr. ROBERTS

3–6 p.m., Tuesday, and 3–4 p.m., Wednesday. Fee $12

A laboratory course in intermediate practical optics with some lectures. The course will include lens cutting by hand and by machine; lens mounting, frame and frameless; advanced neutralizing and decentering; making patterns for odd shaped lenses and edging odd shaped lenses; simple soldering; face measurements; simple bridge bending; the use of various kinds of tools.

The student will be required to surface grind, polish and edge grind and mount lenses made by himself from the rough blank.

The student will be required to supply himself with a set of tools as selected by the instructor.

Prerequisite: Optometry 6

Optometry 15—Theoretical optometry. Mr. CROSS

8:30–10 a.m., Tuesday and Thursday. Fee $18

Prerequisite: Optometry 8, of which Optometry 15 is a continuation.

Optometry 17—Pathological conditions of the eye, general hygiene and hygiene of the eye. Dr. WELZMILLER

10 a.m.–12 m., Thursday. Fee $12

This course aims to give the student careful and detailed instruction in the recognition of the normal state of the eye, and in the differentiation between the normal and the abnormal conditions. The hygiene of the eye will be dealt with thoroughly. No attempt will be made to give a training in diagnosing or treating disease.

Prerequisites: Optometry 3 and Optometry 4.

Optometry 19—Practical optometry. Mr. CROSS

8:30–10 a.m., Monday and Friday. Fee $12

This course in practical optometry necessarily covers manual training in the use of mechanical appliances for making examinations of the eyes and measurement of the powers of vision.

Instruction is given in the art of practically adapting the various forms of lenses to the correction of vision, together with the use of instruments that measure the eye in a similar manner to the engineer's method of triangulation in topography.

The course also covers instruction in advanced methods for ascertaining the actual optical conditions of the eyes, when functioning for both near and distant vision, so as to enable the student to deal with so-called muscular deficiencies and spasms. The aim is to have every student become thoroughly proficient in all that is essential to successful optometric practice.

In this course each student makes thorough examinations of the eyes of his fellow students under the direct supervision of the instructor.

Prerequisite: Optometry 8.

Spring Session

Optometry 10—Theoretical optics. Professor SOUTHALL
11 a.m.–12 m., Monday, Wednesday and Friday. Fee $18

This course, which is a continuation of Optometry 9, will be devoted to the treatment of aberrations (including such matters as astigmatism, curvature, etc., and chromatic aberrations); also aperture and field of view of optical systems; and especially modern spectacle-optics.

Optometry 12—Physiological optics. Professor SOUTHALL
10–11 a.m., Tuesday, Room 609 Fayerweather. Fee $6

This is a continuation of Optometry 11.

Optometry 14—Practical optics. Professor WOLL and Mr. ROBERTS
3–6 p.m., Tuesday, and 3–4 p.m., Wednesday. Fee $12

This is an advanced course in practical workshop and fitting room methods and will consist of laboratory work and lectures. The course will deal with the selection of mountings, the various "clips" and their relative merits, the adjustment of spectacles and eyeglasses, tools, fitting tables, stock and records. Grinding simple prisms and prisms in combination with spherical, cylindrical and sphero-cylindrical lenses. Grinding and finishing bifocal lenses, cut, cemented and fused. Automatic lens edging.

During the course visits will be made to some of the wholesale houses and lens laboratories; also, if possible, a trip will be made to one of the large optical factories.

A complete set of tools will be needed in this course.

Prerequisites: Optometry 6 and Optometry 13.

Optometry 16—Theoretical optometry. Mr. CROSS
8:30–10 a.m., Monday and Thursday. Fee $18

This is a continuation of Optometry 15.

Optometry 18—Pathological conditions of the eye. Dr. WELZMILLER
10 a.m.–12 m., Thursday. Fee $12

This is a continuation of Optometry 17.

Optometry 20—Practical optometry. Mr. CROSS
8:30–10 a.m., Wednesday and Friday. Fee $18

This is a continuation of Optometry 19. The work in the Optometric Clinic, Saturdays, 2–4 p.m., described on page 12, is also a part of this course.

ACADEMIC CALENDAR

1917–1918

1917
July 9—Monday. Eighteenth Summer Session begins.
Aug. 17—Friday. Eighteenth Summer Session ends.
Sept. 10—Monday. Last day for filing applications for entrance and deficiency examinations
Sept. 17—Monday. Entrance and deficiency examinations begin.
Sept. 19—Wednesday. Registration begins.
Sept. 26—Wednesday. Winter Session, 164th year, begins.
Oct. 6—Saturday. Last day for changes in registration.
Nov. 6—Tuesday. Election Day, holiday.
Nov. 28—Wednesday. Annual Thanksgiving Service in St. Paul's Chapel.
Nov. 29—Thursday
to
Dec. 1—Saturday, inclusive, Thanksgiving holidays.
Dec. 9—Sunday. Annual Commemoration Service in St. Paul's Chapel.
Dec. 22—Saturday
to
1918
Jan. 7—Monday, inclusive, Christmas holidays.
Jan. 10—Thursday. Last day for filing applications for entrance examinations.
Jan. 17—Thursday. Mid-year entrance examinations begin.
Jan. 28—Monday. Mid-year examinations in Optics and Optometry begin.
Feb. 4—Monday. Registration begins.
Feb. 5—Tuesday. Winter Session ends.
Feb. 6—Wednesday. Spring Session begins. University Service in St. Paul's Chapel.
Feb. 12—Tuesday. Alumni Day.
Feb. 22—Friday. Washington's Birthday, holiday.
Mar. 28—Thursday
to
April 1—Monday, inclusive, Easter holidays.
May 21—Monday. Final examinations begin.
May 30—Thursday. Memorial Day, holiday.
June 2—Sunday. Baccalaureate Service.
June 3—Monday. Class Day.
June 5—Wednesday. Commencement Day.
June 12—Wednesday. Spring Session ends.
June 17—Monday. Entrance examinations begin.
July 8—Monday. Nineteenth Summer Session opens.
Aug. 16—Friday. Nineteenth Summer Session closes.
Sept. 9—Monday. Last day for filing applications for entrance and deficiency examinations.
Sept. 16—Monday. Entrance and deficiency examinations begin.
Sept. 18—Wednesday. Registration begins.
Sept. 25—Wednesday. Winter Session, 165th year, begins.

SCHEDULE

FIRST YEAR, WINTER SESSION (16 hours a week, including laboratory)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A. M. 9–10	Opt. A_1		Opt. A_1		Opt. A_1	
10–11	Opt. 1	Opt. A_1	Opt. 1	Opt. A_1	Opt. 1	
11–12		Phys. A_1		Phys. A_1		Phys. A_1
P. M. 4–5					Opt. 3	
5–6			Opt. 3		Opt. 3	
7:30–8	Phys. eA_1			Phys. eA_1		
8–9	Phys. eA_1			Phys. eA_1		

Also two hours of laboratory work in Physics

FIRST YEAR, SPRING SESSION (19 hours a week, including laboratory)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A. M. 8–8:30		Opt. 8				
8:30–9		Opt. 8				
9–9:30		Opt. 8				Opt. 8
9:30–10						Opt. 8
10–10:30	Opt. 2		Opt. 2		Opt. 2	Opt. 8
10:30–11	Opt. 2		Opt. 2		Opt. 2	
11–12		Phys. A_2		Phys. A_2		Phys. A_2
P. M. 4–5					Opt. 4	
5–6			Opt. 4		Opt. 4	
7–7:30			Opt. 6			
7:30–8	Phys. eA_2		Opt. 6	Phys. eA_2		
8–9	Phys. eA_2		Opt. 6	Phys. eA_2		
9–10			Opt. 6			

Also four hours of laboratory work in connection with Physics and Optometry 2


NEXT EXPERIMENT

SECOND YEAR, WINTER SESSION (20 hours a week, including laboratory)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A. M. 8:30–9	Opt. 19	Opt. 15		Opt. 15	Opt. 19	
9–10	Opt. 19	Opt. 15		Opt. 15	Opt. 19	
10–11				Opt. 17		
11–12	Opt. 9	Opt. 11	Opt. 9	Opt. 17	Opt. 9	
P. M. 2–3	Opt. 11			Opt. 11		
3–4		Opt. 13	Opt. 13			
4–5		Opt. 13				
5–6		Opt. 13				

Also two hours of laboratory work in connection with Optometry 9, Friday afternoon or Saturday morning

SECOND YEAR, SPRING SESSION (18 hours a week, including clinic)

Hours	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
A. M. 8:30–9	Opt. 16		Opt. 20	Opt. 16	Opt. 20	
9–10	Opt. 16		Opt. 20	Opt. 16	Opt. 20	
10–11		Opt. 12		Opt. 18		
11–12	Opt. 10		Opt. 10	Opt. 18	Opt. 10	
P. M. 3–4		Opt. 14	Opt. 14			
4–5		Opt. 14				Clinic
5–6		Opt. 14				Clinic